

Matrox Odyssey Xpro

Camera Interface Application Note

DALSA Piranha HS-8x-08K80

April 3, 2006

Basics about the
camera

Camera Descriptions

- Effective resolution: up to 8192 pixels/line @ 68k line per second.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- External and internal sync.
- External or internal exposure control.
- 40/80 MHz pixel clock rate.

NOTE the DCFs for this interface require the use of a Matrox Odyssey Xpro main board with the Single-FULL Camera Link grab module

Mode of operations as
per Matrox Imaging (in
parentheses as per
camera manufacturer)

Interface Mode

- Fixed line scan rate (External Sync Mode¹)
- Variable line scan rate (External Sync Mode)
- Fixed line scan rate with frame trigger (External Sync Mode¹)
- Variable line scan rate with frame trigger (External Sync Mode)
- Fixed line scan rate with variable frame size (External Sync Mode¹)
- Variable line scan rate with variable frame size (External Sync Mode)
- Fixed line scan rate (Area scan mode)
- Fixed line scan rate with binning

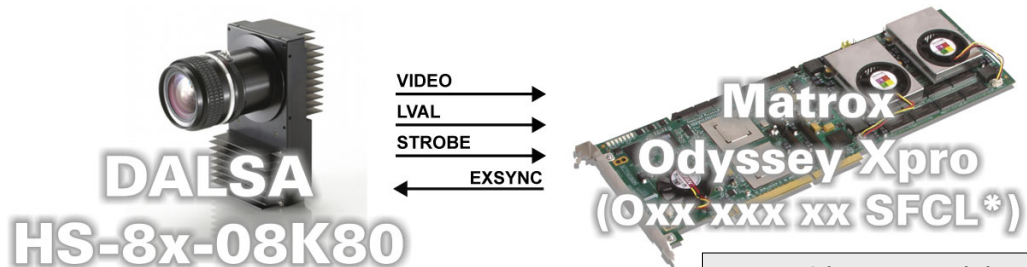
1. or Internal Programmable Sync Mode

Basics about the
interface modes

Camera Interface Briefs

Mode 1: Fixed line scan rate

- Up to 8192 pixels/line.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_8192_8bit8tapsFLS.DCF](#)
- DCF used: [HS8x08k80_8192_12bit4tapsFLS.DCF](#)



*Matrox Odyssey Xpro main board with the Single-FULL Camera Link grab module

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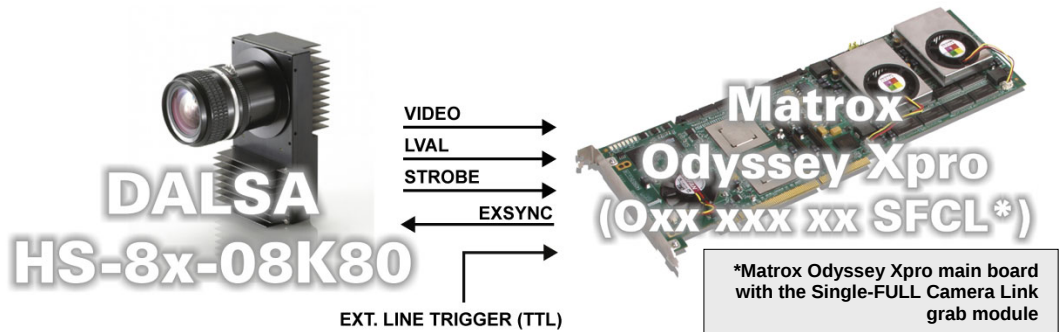
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Basics about the
interface modes

Camera Interface Briefs (continued)

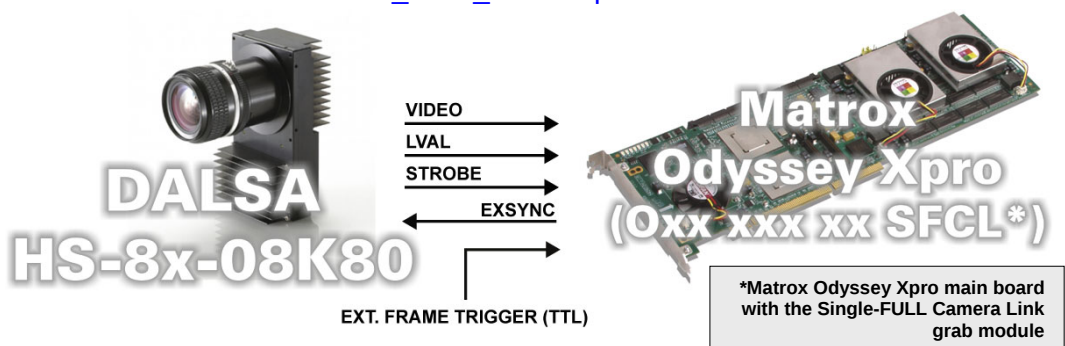
Mode 2: Variable line scan rate

- Up to 8192 pixels/line.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL line trigger signal.
- Matrox Odyssey Xpro sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_8192_8bit8tapsVLS.DCF](#)
- DCF used: [HS8x08k80_8192_12bit4tapsVLS.DCF](#)



Mode 3: Fixed line scan rate with frame trigger

- Up to 8192 pixels/line.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) trigger signal.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_8192_8bit8tapsFLSFT.DCF](#)
- DCF used: [HS8x08k80_8192_12bit4tapsFLSFT.DCF](#)



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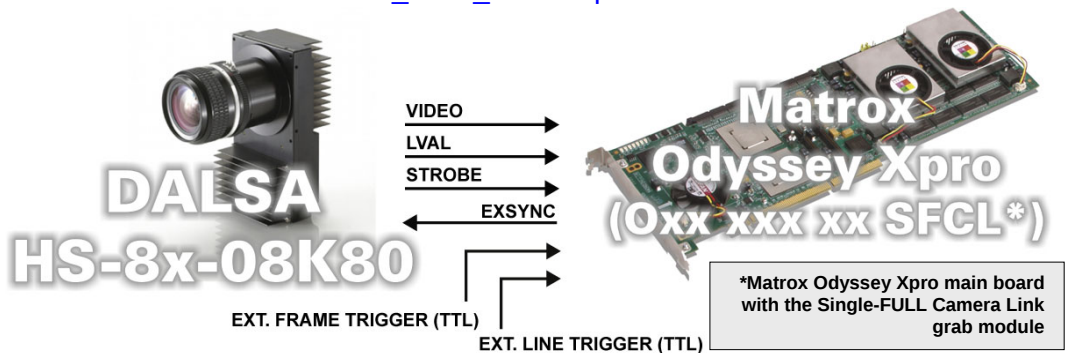
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Basics about the
interface modes

Camera Interface Briefs (continued)

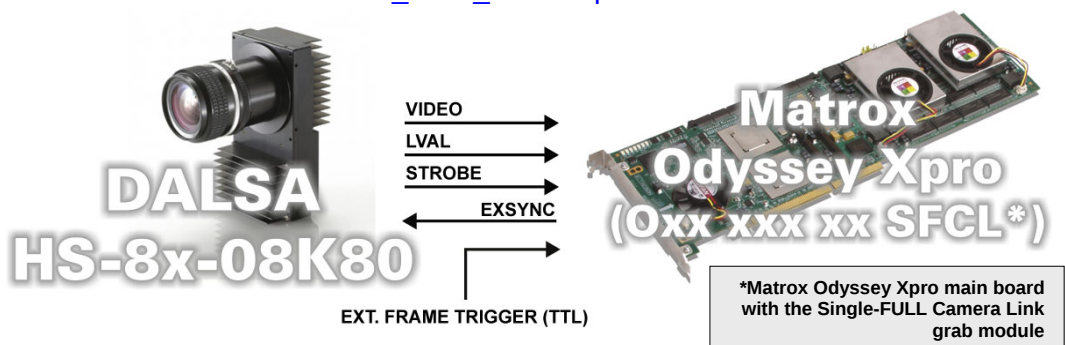
Mode 4: Variable line scan rate with frame trigger

- Up to 8192 pixels/line.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) and line trigger signals.
- Matrox Odyssey Xpro sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_8192_8bit8tapsVLSFT.DCF](#)
- DCF used: [HS8x08k80_8192_12bit4tapsVLSFT.DCF](#)



Mode 5: Fixed line scan rate with variable frame size

- Up to 8192 pixels/line.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) trigger signal.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_8192_8bit8tapsFLSVF.DCF](#)
- DCF used: [HS8x08k80_8192_12bit4tapsFLSVF.DCF](#)



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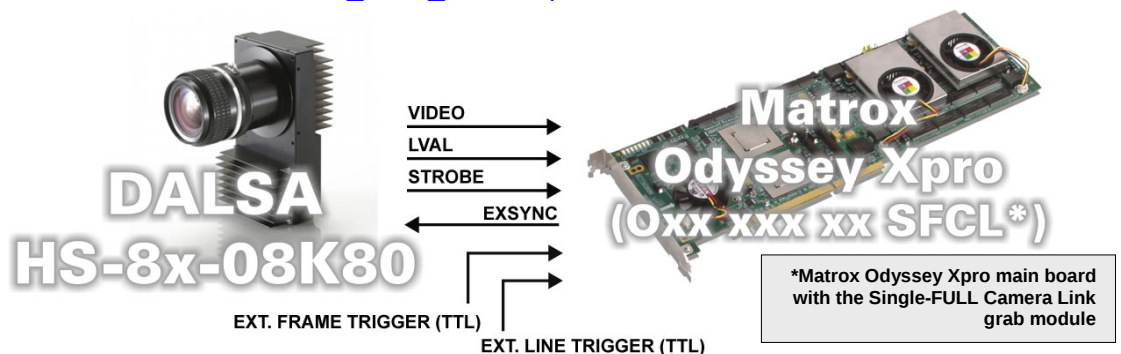
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Basics about the
interface modes

Camera Interface Briefs (continued)

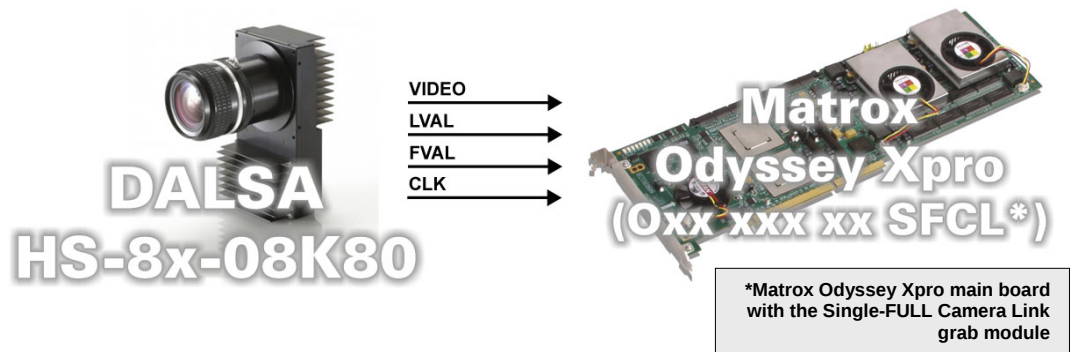
Mode 6: Variable line scan rate with variable frame size

- Up to 8192 pixels/line.
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) and line trigger signals.
- Matrox Odyssey Xpro sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_8192_8bit8tapsVLSVF.DCF](#)
- DCF used: [HS8x08k80_8192_12bit4tapsVLSVF.DCF](#)



Mode 7: Fixed line scan rate (Area scan mode)

- 8192 x 96 (full resolution).
- Camera Link FULL interface (four 12-bit or eight 8-bit taps).
- Matrox Odyssey Xpro receiving VSYNC (FVAL), HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS4x02k30_8192x96_8bit8tapsAM.DCF](#)



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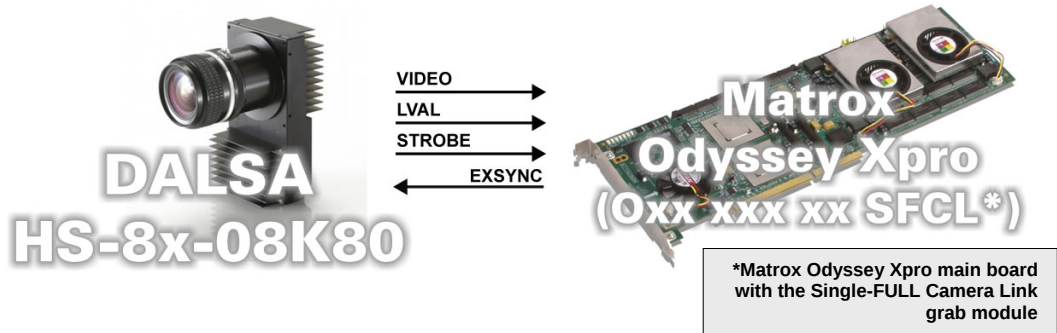
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Basics about the
interface modes

Camera Interface Briefs (continued)

Mode 8: Fixed line scan rate with binning

- Up to 4096 pixels/line.
- Camera Link FULL interface (eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (STROBE @ 40/80 MHz) and video data from camera.
- DCF used: [HS8x08k80_4096_8bit8tapsBIN2FLS.DCF](#)



Specifics about the
interface modes

Camera Interface Details

Mode 1: Fixed line scan rate

- **Line rate:** The frequency of the periodic EXPOSURE1 (EXSYNC) signal determines the camera's line rate. The EXPOSURE1 (EXSYNC) signal period is set in the DCFs to **15 μ s** (or **30 μ s** for 12-bit/4 taps) which translates into a **66.6 kHz** (or **32 kHz** for 12-bit/4 taps) line rate. The maximum line rate for this camera equals **68 kHz** (or **36 kHz** for 12-bit/4 taps).
- **Exposure time:** Since the camera used a TDI sensor, the exposure time is the period between the falling edges of the EXPOSURE1 (EXSYNC) signals, and is equal to the line rate. The default exposure time for the DCFs equals **15 μ s** (**30 μ s** for 12-bit/4 taps). The maximum and minimum exposure times per line for the DCFs are **210 ms** and **$\approx 14.7 \mu$ s** respectively. The exposure time can be modified in the DCFs using Matrox Intellicam, ONL imCamControl() or imDigControl() function, or with the MIL MdigControl() function. Consult the respective manual for more information.

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Specifics about the
interface modes

Camera Interface Details

Mode 1: Fixed line scan rate

- **Camera communication:** The DCFs will work with the **Internal Programmable Sync Mode** and **External Sync Mode**. Set the mode (as shown in table below) via the Camera Link communication. Refer to the camera manual for additional information.

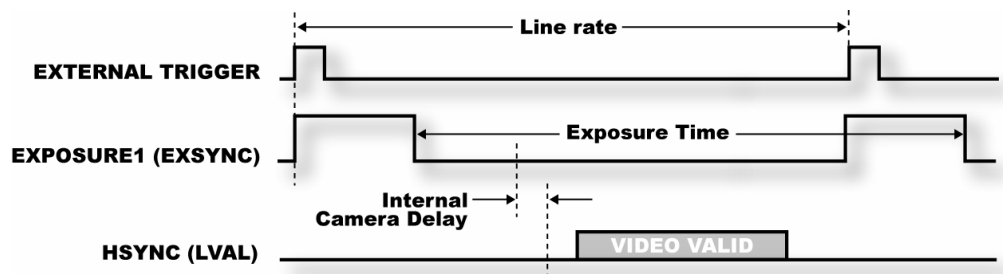
Command	Short Form	Parameter	Description
Set_exposure_mode	sem	7 or 3	Internal Programmable Sync Mode or External Sync Mode
Camera Link mode	clm	16	4 taps, 12-bits output
Camera Link mode	clm	21	8 taps, 8-bits output

Mode 2: Variable line scan rate

- **Line rate:** The line rate is controlled by the frequency of the external TTL line trigger signal. The line trigger signal period must be larger than the total duration of the exposure time (high level duration of the timer), the internal delay of the camera ($\approx 1.50 \mu\text{s}$) and the line read out ($12.8 \mu\text{s}$ @ 80 MHz, 8 taps).
- **Exposure time:** The exposure time is the period between the falling edges of the EXPOSURE1 (EXSYNC) signals (see Timing Diagram below) and controlled by the period of the external line trigger signal. **NOTE** that the frequency of the external line trigger signal must be consistent otherwise the intensity of the individual lines will be affected. Moreover, if a line trigger signal arrives before the end of the camera read-out period, the camera will ignore the EXSYNC signal for this line.
- **Camera communication:** Set the mode (as shown in table below) via the Camera Link communication. Refer to the camera manual for additional information.

Command	Short Form	Parameter	Description
Set_exposure_mode	sem	3	External Sync Mode
Camera Link mode	clm	16	4 taps, 12-bits output
Camera Link mode	clm	21	8 taps, 8-bits output

- **Timing diagram:**



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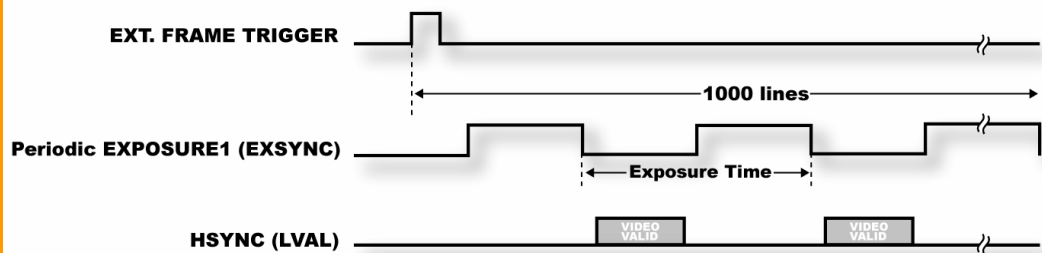
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Specifics about the
interface modes

Camera Interface Details (continued)

Mode 3: Fixed line scan rate with frame trigger

- **Line/frame rate:** The line rate is fixed and controlled by the period of EXPOSURE1 (EXSYNC) signal. The virtual frame rate is variable and controlled by the period of the external frame trigger signal, however the external trigger period must always be greater than the total time of the number of lines captured. The number of lines per virtual frame (maximum of 1000 for the DCFs) is fixed and controlled by the vertical timing of the DCFs. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate.
- **Timing diagram:**



Mode 4: Variable line scan rate with frame trigger

- **Line/frame rate:** The line rate is controlled by the frequency of the external TTL line trigger signal. The line trigger signal period must be larger than the total duration of the exposure time (high level duration of the timer), the internal delay of the camera ($\approx 1.50 \mu\text{s}$) and the line rate ($12.8 \mu\text{s}$ @ 80 MHz, 8 taps). The virtual frame rate is variable and controlled by the period of the external frame trigger signal, however the external trigger period must always be greater than the total time of the number of lines captured. The number of lines per virtual frame (maximum of 1000 for the DCFs) is fixed and controlled by the vertical timing of the DCFs. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 2: Variable line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.

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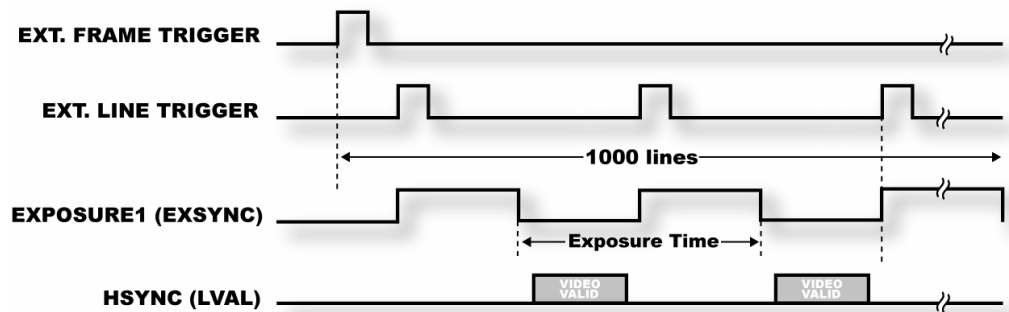
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Specifics about the
interface modes

Camera Interface Details (continued)

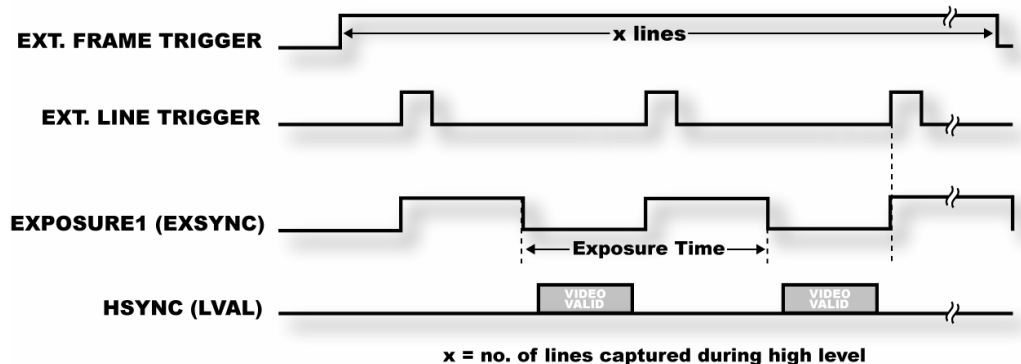
Mode 4: Variable line scan rate with frame trigger

▪ Timing diagram:



Mode 5: Fixed line scan rate with variable frame size

- **Line/frame rate:** The line rate is fixed and controlled by the period of EXPOSURE1 (EXSYNC) signal. The number of lines per virtual frame (maximum of 1000 for the DCFs) is variable and controlled by the frame trigger signal. Matrox Odyssey captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCFs. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate
- **Timing diagram:**



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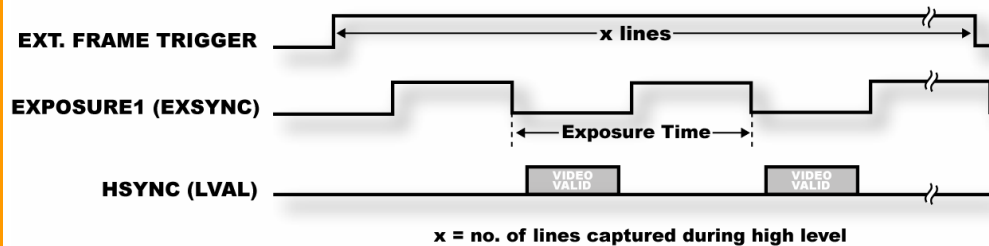
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Specifics about the
interface modes

Camera Interface Details (continued)

Mode 6: Variable line scan rate with variable frame size

- **Line/frame rate:** The line rate is variable and controlled by the external line trigger frequency. The number of lines per virtual frame (maximum of 1000 for the DCFs) is variable and controlled by the frame trigger signal. Matrox Odyssey Xpro captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCFs. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Exposure time can be modified using the command.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.
- **Timing diagram:**



Mode 7: Fixed line scan rate (area scan mode)

- **Frame rate:** Matrox Odyssey Xpro receives the continuous video from the camera (Full resolution). The frame rate is controlled by the camera; refer to the camera manual for more information.
- **Exposure time:** The exposure time is controlled by the camera; refer to the camera manual for more information.
- **Camera communication:** Set the mode (as shown in table below) via the Camera Link communication. Refer to the camera manual for additional information.

Command	Short Form	Parameter	Description
Set_exposure_mode	sem	7	Internal Programmable Sync Mode
Set_tdi_mode	tdi	1	Area mode
Camera Link mode	clm	21	8 taps, 8-bits output

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Specifics about the
interface modes

Camera Interface Details (continued)

Mode 8: Fixed line scan rate with binning

- **Line rate:** The frequency of the periodic EXPOSURE1 (EXSYNC) signal determines the camera's line rate. The EXPOSURE1 (EXSYNC) signal period is set in the DCFs to **15 μ s** (or **30 μ s** for 12-bit/4 taps) which translates into a **66.6 kHz** (or **32 kHz** for 12-bit/4 taps) line rate. The maximum line rate for this camera equals **68 kHz** (or **36 kHz** for 12-bit/4 taps).
- **Exposure time:** Since the camera used a TDI sensor, the exposure time is the period between the falling edges of the EXPOSURE1 (EXSYNC) signals, and is equal to the line rate. The default exposure time for the DCFs equals **15 μ s** (**30 μ s** for 12-bit/4 taps). The maximum and minimum exposure times per line for the DCFs are **210 ms** and **$\approx 14.7 \mu$ s** respectively. The exposure time can be modified in the DCFs using Matrox Intellicam, ONL imCamControl() or imDigControl() function, or with the MIL MdigControl() function. Consult the respective manual for more information.
- **Camera communication:** Set the mode (as shown in table below) via the Camera Link communication. Refer to the camera manual for additional information.

Command	Short Form	Parameter	Description
Set_exposure_mode	sem	7 or 3	Internal Programmable Sync Mode or External Sync Mode
Camera Link mode	clm	21	8 taps, 8-bits output
Set binning horizontal	sbh	2	Binning

Cabling details for the
interface modes

Cabling Requirements

Mode 1: Fixed line scan rate

- **Cable and Connection:** Standard Camera Link cable.

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Cabling details for the
interface modes

Cabling Requirements

Mode 2: Variable line scan rate

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External line trigger should be connected to the OPTO TRIG input of the 9-pin connector (pins 7 and 2) on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin Name	Pin no.		External Trigger Source Pin Name
OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)

Mode 3: Fixed line scan rate with frame trigger

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External line trigger should be connected to the OPTO TRIG input of the 9-pin connector (pins 4 and 5) on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin Name	Pin no.		External Trigger Source Pin Name
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)

Mode 4: Variable line scan rate with frame trigger

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External frame and line triggers should be connected to the OPTO TRIG inputs of the 9-pin connector on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin name	Pin no.		External Trigger Sources Pin name
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)
OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)

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Cabling details for the
interface modes

Cabling Requirements

Mode 5: Fixed line scan rate with variable frame size

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External trigger should be connected to the OPTO TRIG input (pins 4 and 5) of the 9-pin connector on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin name	Pin no.
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External Trigger Sources

Pin name

OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
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OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)
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Mode 6: Variable line scan rate with variable frame size

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External frame and line triggers should be connected to the OPTO TRIG inputs of the 9-pin connector on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin name	Pin no.
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External Trigger Sources

Pin name

OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
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OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)
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OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
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OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)
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Mode 7: Fixed line scan rate (Area scan mode)

- **Cable and Connection:** Standard Camera Link.

Mode 8: Fixed line scan rate with binning

- **Cable and Connection:** Standard Camera Link.

The DCFs mentioned in this application note are also attached (embedded) to this PDF file – use the Adobe Reader's View File Attachment to access the DCF files. The information furnished by Matrox Electronics System, Ltd. is believed to be accurate and reliable. Please verify all interface connections with camera documentation or manual. Contact your local sales representative or Matrox Sales office or Matrox Imaging Applications at 514-822-6061 for assistance. © Matrox Electronic Systems Ltd, 2006-2011.

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